

The African Organisation for Standardisation

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ARS 859 (2012) (English): Brown rice --
Specification



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Brown rice — Specification



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Foreword

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This African Standard was prepared by the ARSO Technical Harmonization Committee on Agriculture and Food Products (ARSO/THC 1).

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Introduction

Rice is the second most consumed cereal grain. It provides more than one fifth of the calories consumed worldwide by humans.

On the African continent, rice is grown in a wide range of climatic conditions, from river deltas to mountainous regions and mainly uses rain-fed systems. Predicted demands for rice remain strong. An additional 116 million tons of rice will be needed by 2035 to feed growing populations. In Africa, where rice is the most rapidly growing food source, about 30 million tons more rice will be needed by 2035, representing an increase of 130% in rice consumption from 2010.

Brown rice has had only its husk removed during milling. Brown rice has a higher nutritional value when compared to the milled and polished rice (white rice). With the bran intact, it retains more fibre, folacin, iron, riboflavin, potassium, phosphorus, zinc, and trace minerals such as copper and manganese, than other types of rice. Moreover, brown rice is the only form of the grain that contains vitamin E.

Brown rice — Specification

1 Scope

This African Standard specifies the requirements and methods of sampling and test for brown rice of the varieties grown from *Oryza spp.*, intended for human consumption or for processing to milled rice.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

WD-ARS 858-2012, *Rough (paddy) rice — Specification*

AOAC Official Method 2001.04, *Determination of Fumonisin B₁ and B₂ in corn and corn flakes — Liquid chromatography with immunoaffinity column cleanup*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

ISO 605, *Pulses — Determination of impurities, size, foreign odours, insects, and species and variety — Test methods*

ISO 711, *Cereals and cereal products — Determination of moisture content (Basic reference method)*

ISO 712, *Cereals and cereal products — Determination of moisture content — Routine reference method*

ISO 5223, *Test sieves for cereals*

ISO 5984, *Animal feeding stuffs — Determination of crude ash*

ISO 6579, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection of Salmonella spp.*

ISO 6639-1, *Cereals and pulses — Determination of hidden insect infestation — Part 1: General principles*

ISO 6639-2, *Cereals and pulses — Determination of hidden insect infestation — Part 2: Sampling*

ISO 6639-3, *Cereals and pulses — Determination of hidden insect infestation — Part 3: Reference method*

ISO 6639-4, *Cereals and pulses — Determination of hidden insect infestation — Part 4: Rapid methods*

ISO 6888-1, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (Staphylococcus aureus and other species) — Part 1: Technique using Baird-Parker agar medium*

ISO 6888-2, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (Staphylococcus aureus and other species) — Part 2: Technique using rabbit plasma fibrinogen agar medium*

ISO 6888-3, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (Staphylococcus aureus and other species) — Part 3: Detection and MPN technique for low numbers*

ISO 7251, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of presumptive Escherichia coli — Most probable number technique*

ISO 13690, *Cereals, pulses and milled products — Sampling of static batches*

ISO 16050, *Foodstuffs — Determination of aflatoxin B₁, and the total content of aflatoxin B₁, B₂, G₁ and G₂ in cereals, nuts and derived products — High performance liquid chromatographic method*

ISO 20483, *Cereals and pulses — Determination of the nitrogen content and calculation of the crude protein content — Kjeldahl method*

ISO 21527-2, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of yeasts and moulds — Part 2: Colony count technique in products with water activity less than or equal to 0.95*

3 Definitions

For the purpose of this standard the following definitions apply.

3.1

paddy

paddy rice

rough rice

whole or broken kernels of paddy rice from (*Oryza glaberrima*, *Oryza sativa*, *Oryza longistaminata*) retaining its husk after threshing

3.2

husked rice

brown rice

cargo rice

paddy from which the husk only has been removed

NOTE The processes of husking and handling may result in some loss of bran.

3.3

milled rice

white rice

husked rice from which almost all of the bran and embryo (germ) have been removed by milling

3.3.1

undermilled rice

milled rice obtained by milling husked rice, but not to the degree necessary to meet the requirements of well-milled rice

3.3.2

well-milled rice

milled rice obtained by milling husked rice in such a way that most of the bran and part of the embryo have been removed

3.3.3

extra-well-milled rice

milled rice obtained by milling husked rice in such a way that almost all of the bran and the embryo have been removed

3.4

parboiled rice

husked or milled rice processed from paddy or husked rice that has been soaked in water and subjected to a heat treatment so that the starch is fully gelatinized, followed by a drying process

3.5

waxy rice

glutinous rice

varieties of rice whose kernels have a white and opaque appearance

NOTE The starch of waxy rice consists almost entirely of amylopectin. The kernels have a tendency to stick together after cooking.

3.6

whole kernel

husked or milled kernel without any broken part, or part of kernel with a length greater than or equal to nine-tenths of the average length of the test sample kernels

NOTE See Figure 1.

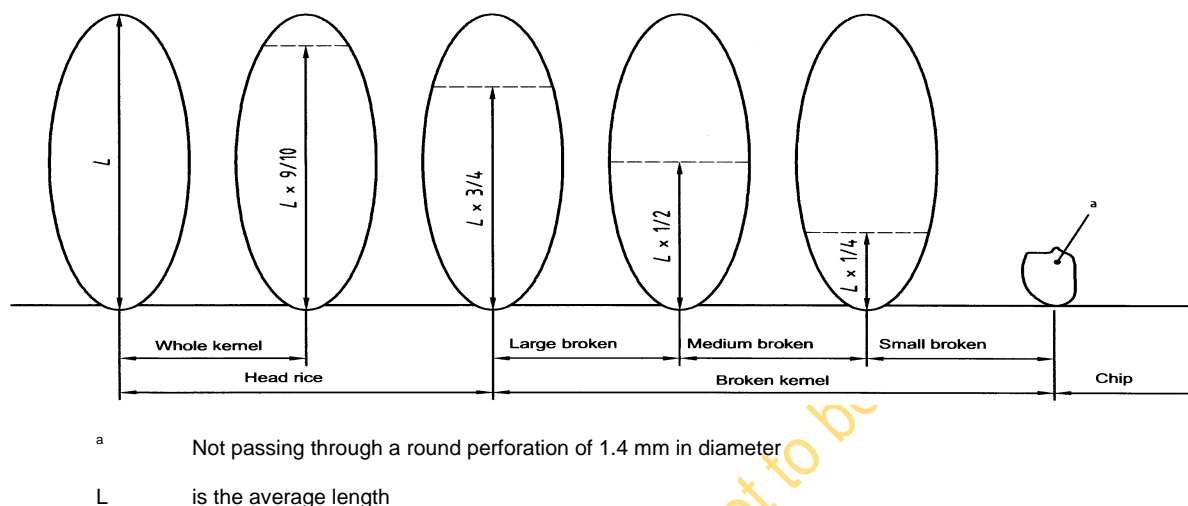


Figure 1 — Size of kernels, broken kernels and chips

3.7

head rice

whole kernel or part of kernel with a length greater than or equal to three-quarters of the average length of the test sample kernels

NOTE See Figure 1.

3.8

large broken kernel

part of kernel with a length less than three-quarters but greater than one-half of the average length of the test sample kernels

NOTE See Figure 1.

3.9

medium broken kernel

part of kernel with a length less than or equal to one-half but greater than one-quarter of the average length of the test sample kernels

NOTE See Figure 1.

3.10

small broken kernel

part of kernel with a length less than or equal to one-quarter of the average length of the test sample kernels but which does not pass through test sieve with round apertures having diameter 1.4 mm

NOTE See Figure 1.

3.11

chip

part of kernel which passes through a test sieve complying with ISO 5223, and with round apertures having diameter 1.4 mm

3.12

average length, L

arithmetic mean of the length of the test sample kernels that are not immature or malformed and without any broken parts

3.13

extraneous matter

inorganic and organic components other than whole or broken kernels of rice

3.13.1

inorganic extraneous matter

inorganic components, such as stone, sand and dust

3.13.2

organic extraneous matter

extraneous matter including edible and non-edible

3.13.2.1

edible organic extraneous matter

extraneous matter, such as bran, non-toxic foreign seeds, flour lumps, and other food

3.13.2.2

non-edible organic extraneous matter

extraneous matter, including husks, pieces of straw, and impurities of animal origin, such as dead insects and their fragments

3.14

heat-damaged kernel

head rice or broken kernel that has changed its normal colour as a result of microbiological heating

NOTE This category includes kernel that is yellow to dark yellow in the case of non-parboiled rice and orange to dark orange in the case of parboiled rice, due to a microbiological alteration.

3.15

damaged kernel

head rice or broken kernel showing evident deterioration due to moisture, pests, disease or other causes, but excluding heat-damaged kernels

3.15.1

spotted kernel

whole or broken kernel showing a well defined small circle of dark colour or more or less regular shape

3.15.2

stained kernel

whole or broken kernel which has undergone on a small area of its surface an obvious change in its natural colour. The stains may be of different colours e.g., blackish, reddish and brown. Deep black striations are also considered stains.

3.15.3

pecks

head rice or broken kernel of parboiled rice of which more than one-quarter of the surface is dark brown or black in colour due to the parboiling process

3.15.4

immature kernel

a whole or broken kernel which is undeveloped

3.15.5

shrivel kernel

a kernel which has become shrunken and wrinkled from great heat or lack of moisture

3.15.6**black kernel**

a kernel showing a distinctly dark colouration

3.15.7**over-dried damaged**

refers to defective grains caused by overheating during artificial drying. It can be detected where grain is hot, exhibits an unusual odour, exhibits significant sprouting (greater than 10%) or other evidence of weather damage

3.15.8**smutty rough rice**

rough rice which contains more than 3.0 percent of smutty kernels

3.16**immature kernel****malformed kernel**

head rice or broken kernel which is unripe or badly developed

3.17**chalky kernel**

head rice or broken kernel of non-parboiled rice, except waxy rice, whose whole surface has an opaque and floury appearance

3.18**red kernel**

head rice or broken kernel having a red bran covering more than one-quarter of its surface

3.19**red-streaked kernel**

head rice or broken kernel with red bran streaks of length greater than or equal to one-half of the average length, but where the surface covered by these red streaks is less than one-quarter of the total surface

3.20**partly gelatinized kernel**

ungelatinized kernels

non-gelatinized kernels

head rice or broken kernel of parboiled rice which is not fully gelatinized and shows a distinct white opaque area

3.21**milling yield**

an estimate of the quantity of whole kernels and total milled rice (whole and broken kernels combined) that are produced in the milling of rough rice to a well-milled degree

3.22**parboiled rough rice**

rough rice in which the starch has been gelatinized by soaking, steaming, and drying. If the rice is:

- (1) Not distinctly coloured by the parboiling process, it is considered "Parboiled Light";
- (2) distinctly but not materially coloured by the parboiling process, it is considered "Parboiled";
- (3) materially coloured by the parboiling process, it is considered "Parboiled Dark."

3.23**poisonous, toxic and/or harmful seeds**

any seed which if present in quantities above permissible limit may have damaging or dangerous effect on health, organoleptic properties or technological performance such as Jimson weed —

datura (*D. fastuosa* Linn and *D. stramonium* Linn.) corn cokle (*Agrostemma githago* L., *Machai Lallium remulenum* Linn.) Akra (*Vicia* species), *Argemone mexicana*, Khesari and other seeds that are commonly recognized as harmful to health

3.24

enriched rice

forms of milled rice to which nutrients or enriching substances have been added

3.25

green/immature kernel

a whole or broken kernel, which is undeveloped and may be green in colour.

3.25.1

yellow kernel

a whole kernel, which has undergone, totally or partially, through heating or other causes, a change in its natural colour and has taken a lemon or orange-yellow tone

3.25.2

amber kernel

a whole kernel, which has undergone thorough heating or other causes, a slight uniform change in colour over the whole surface; this change alters the colour of the kernel to a slight amber-yellow

4 Quality requirements

4.1 Classification

Rice shall be classified as follows:

4.1.1 Long grain rice — Rice with 80% or more of kernels after milling to a well-milled degree, having a length of at least 6.67 mm and a length/width ratio of over 3.0.

4.1.2 Medium grain rice — Rice with 80% or more of kernels after milling to a well-milled degree, having a length of 6.20 to 6.66 mm and a length/width ratio between 2.0 and 3.0.

4.1.3 Short grain rice — Rice with 80% or more of kernels after milling to a well-milled degree, having a length of less than 6.20 mm and a length/width ratio of less than 2.0.

4.2 Raw material

The rough rice from which the brown rice is obtained shall be of sound quality, free from sand, have characteristic odour and flavour complying with WD-ARS 858:2012.

4.3 General requirements

Brown rice shall meet the following general requirements/limits as determined using the relevant standards listed in Clause 2:

- a) shall be the dried mature grains of edible *Oryza spp*;
- b) be clean, wholesome, uniform in size, colour and shape;
- c) shall be safe and suitable for human consumption;
- d) shall be free from abnormal flavours, musty, sour or other undesirable odour, obnoxious smell and discolouration;
- e) shall be free from micro-organisms and substances originating from micro-organisms, fungi or other poisonous or deleterious substances in amounts that may constitute a hazard to human health.

4.4 Specific requirements

4.4.1 Grading

Brown rice for human consumption may be graded into three grades on the basis of the tolerable limits established in Table 1 which shall be additional to the general requirements set out in this standard.

4.4.2 Ungraded brown rice

Ungraded brown rice shall be brown rice which do not fall within the requirements of Grades 1, 2 and 3 of this standard but meet the minimum requirements provided in 4.4 and are not rejected brown rice. Ungraded brown rice can be sorted out to Grade 1, 2 or 3 in accordance with the relevant grading procedures.

4.4.3 Reject grade brown rice

This comprises brown rice which has objectionable odour, off flavour, living insects or which do not possess the quality characteristics specified in Table 1. It cannot satisfy the conditions of ungraded brown rice and shall be graded as reject brown rice and shall be regarded as unfit for human consumption.

Table 1 — Specific requirements

Characteristics	Maximum limits			Test Method
	Grade 1	Grade 2	Grade 3	
Head rice yield, % m/m, min.	84.0	79.0	75.0	ISO 605
Total milled yield, % m/m, min.	88.0	85.0	82.0	ISO 605
Broken, %, max	2.0	6.0	8.0	ISO 605
Heat damaged rice, %, max	1.5	1.5	2.0	
Damaged rice, %, max	1.0	2.5	4.0	
Non-parboiled kernels, % m/m max	0.1	0.5	1.0	
Partly gelatinized kernels, % m/m	2.0	8.0	11.0	
Non-gelatinized kernels, % m/m	0.1	0.2	0.4	
Chalky kernels, % max.	2.0	4.0	6.0	
Red or red streaked, %, max.	1.0	4.0	12.0	
Green/immature grains, %, max	2.0	6.0	8.0	
Other contrasting varieties, % max	1.0	2.0	5.0	
Organic matters, %, max	0.1	0.5	1.0	
Inorganic matters, %, max	0.1	0.1	0.5	
Live weevils/kg, max	Nil	Nil	Nil	
Filth, %, max	0.1	0.1	0.1	
Paddy grains, %, max.	1.0	2.0	2.5	
Moisture contents, %, max	14.0	14.0	14.0	ISO 712
Total aflatoxin (AFB1+AFB2+AFG1+AFG2)), ppb, max	10			ISO 16050
Aflatoxin B1 only, ppb, max	5			
Fumonisin, ppm, max	2			AOAC 2001.04

5 Contaminants

5.1 Heavy metals

Brown rice shall comply with those maximum limits for heavy metals established by the Codex Alimentarius Commission for this commodity.

5.2 Pesticide residues

Brown rice shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity

5.3 Mycotoxin limits

Brown rice shall comply with those maximum mycotoxin limits established by the Codex Alimentarius Commission for this commodity. In particular, total aflatoxin levels in brown rice for human consumption shall not exceed 10 µg/kg (ppb) with B₁ not exceeding 5 µg/kg (ppb) when tested according to ISO 16050.

6 Hygiene

6.1 Brown rice shall be produced, prepared and handled in accordance with the provisions of appropriate sections of ARS 53.

6.2 When tested by appropriate standards of sampling and examination listed in Clause 2, the products:

- shall be free from microorganisms in amounts which may represent a hazard to health and shall not exceed the limits stipulated in Table 2;
- shall be free from parasites which may represent a hazard to health; and
- shall not contain any substance originating from microorganisms in amounts which may represent a hazard to health.

Table 2 — Microbiological limits

	Type of micro-organism	Limits	Test method
i)	Yeasts and moulds, max. per g	10 ²	ISO 21527-2
ii)	<i>S.aureus</i> per 25 g	Not detectable	ISO 6888
iii)	<i>E. Coli</i> , max. per g	Not detectable	ISO 7251
iv)	<i>Salmonella</i> , max. per 25 g	Not detectable	ISO 6579

7 Packaging

7.1 Brown rice shall be packed in suitable packages which shall be clean, sound, free from insect, fungal infestation and the packing material shall be of food grade quality.

7.2 Brown rice shall be packed in containers which will safeguard the hygienic, nutritional, technological and organoleptic qualities of the products.

7.3 The containers, including packaging material, shall be made of substances which are safe and suitable for their intended use. They shall not impart any toxic substance or undesirable odour or flavour to the product.

- 7.4** Each package shall contain rice of the same type and of the same grade designation.
- 7.5** If brown rice is presented in bags, the bags shall also be free of pests and contaminants.
- 7.6** Each package shall be securely closed and sealed.

8 Labelling

8.1 In addition to the requirements in ARS 56, each package shall be legibly and indelibly marked with the following:

- i) product name as “Brown Rice”;
- ii) variety;
 - o Long grain brown rice
 - o Medium grain brown rice
 - o Short grain brown rice
 - o Mixed brown rice
- iii) grade;
- iv) name, address and physical location of the producer/ packer/importer;
- v) lot/batch/code number;
- vi) net weight, in kg;
- vii) the declaration “Food for Human Consumption”
- viii) storage instruction as “Store in a cool dry place away from any contaminants”;
- ix) crop year;
- x) packing date;
- xi) instructions on disposal of used package;
- xii) country of origin;
- xiii) a declaration on whether the brown rice was genetically modified or not.

9 Sampling methods

Sampling shall be done in accordance with the ISO 13690.

Annex A
(normative)

Methods of analysis for rice specifications

A.1 Principle

Manual separation and weighing of the broken kernels and of the categories in Table 1.

A.2 Apparatus

A.2.1 Sample divider, conical sampler or multiple-slot sampler with a distribution system in accordance with ISO 13690.

A.2.2 Metal sieve, with round perforation 1.4 mm in diameter in accordance with ISO 5223.

A.2.3 Tweezers, scalpel and paintbrush

A.2.4 Small bowls

A.2.5 Balance, capable of weighing to the nearest 0.01 g.

A.2.6 Tray, or other means, coloured in contrast with the colour of the rice to be evaluated.

A.2.7 Micrometer, or other measuring device not deforming the kernels and capable of being read to the nearest 0.01 mm.

A.3 Sampling

Sampling is not part of the method specified in this standard. A recommended sampling method is given in ISO 24333.

It is important the laboratory receive a truly representative sample which has not been damaged or changed during transport or storage.

A.4 Procedure

A.4.1 General

Note if an odour, particular or foreign to rice, is detected, as well as the presence of all anomalies.

Verify the presence of living or dead insects by visual examination and report their number.

A.4.2 Preparation of test sample

Weigh and carefully mix the laboratory sample to make it as uniform as possible. Then proceed to reduce it, if necessary, using a sample divider (A.2.1) to obtain a quantity of about 800 g.

Divide the test sample so obtained into two equal test portions of about 400 g, using the sample divider (A.2.1).

A.4.3 Determination

A.4.3.1 General

When a kernel or a part of kernel can be classified in more than one category with reference to Table 1, it shall be classified in the category where the maximum permissible value is the lowest. All parts of

kernels which get stuck in the apertures of a test sieve shall be considered as being retained by the test sieve.

A.4.3.2 Average length

On one of the two test portions (A.4.2):

- separate two sets of 100 kernels without any broken part, by random sampling;
- measure the length of the kernels using the micrometer (A.2.7) and calculate the arithmetic means of the length for both sets of kernels (L_1 and L_2);
- calculate the average length of the two sets of kernels $(L_1 + L_2)/2$; if the value of $100(L_1 - L_2)/L$ is higher than 2, return all the kernels to the tray and repeat from step a);
- return all the kernels to the test portion.

A.4.3.3 Coefficient of variation of the length

From the measures of kernels in A.4.3.2 b), calculate the coefficient of variation as follows.

The values are:

$$L_1, L_2 \dots L_i \dots L_n$$

where L_i is the length of a single rice kernel.

The arithmetic mean is given by:

$$\bar{L} = \frac{\sum_{i=1}^n L_i}{n}$$

The standard deviation is given by:

$$s = \sqrt{\frac{\sum_{i=1}^n L_i^2 - \frac{\left(\sum_{i=1}^n L_i\right)^2}{n}}{n-1}}$$

The coefficient of variation, expressed as a percentage, is given by

$$C_v = \frac{s}{\bar{L}} \times 100 \%$$

Usually, the coefficient of variation of an homogeneous lot of rice does not exceed a value of 5 %.

A.4.3.4 Husked rice, non-parboiled (see Figure A.1)

Weigh one of the test portions (A.4.2) to the nearest 0.1 g, record the mass as mw , and spread it on the tray (A.2.6). Separate the inorganic extraneous matter, the organic extraneous matter, the paddy, the milled rice non-parboiled, the husked rice parboiled and the milled rice parboiled, into small bowls (A.2.4), with the aid of tweezers, scalpel and paintbrush (A.2.3). Weigh the six fractions obtained to the nearest 0.01 g, and record the masses as m_1 , m_2 , m_3 , m_4 , m_5 , and m_6 .

Divide the second test portion with the divider (A.2.1) in order to obtain four different aliquot parts of about 100 g each.

Weigh the first aliquot part to the nearest 0.01 g and record the mass as m_x . Spread it out and separate the damaged kernels, the immature or malformed kernels and the red kernels into small bowls. Weigh the three fractions obtained to the nearest 0.01 g, and record the masses as m_7 , m_8 , and m_9 .

Weigh the second aliquot part to the nearest 0.01 g and record the mass as m_y . Separate the chips by the test sieve (A.2.2), then spread out the remainder and separate the broken kernels, classifying them into large broken kernels, medium broken kernels, and small broken kernels. Put the fractions obtained into small bowls. Weigh the four fractions to the nearest 0.01 g and record the masses as m_{10} , m_{11} , m_{12} , and m_{13} .

Proceed with the laboratory milling of the third aliquot part. Weigh the obtained milled rice to the nearest 0.01 g and record the mass as m_z . Spread it out and separate the heat-damaged kernels, the chalky kernels and waxy rice into small bowls. Weigh the three fractions obtained to the nearest 0.01 g and record the masses as m_{14} , m_{15} , and m_{16} .

A.4.3.5 Milled rice, non-parboiled (see Figure A.2)

Weigh one of the test portions (A.4.2) to the nearest 0.1 g, record the mass as m_w , and spread it on the tray (A.2.6). Separate the inorganic extraneous matter, the organic extraneous matter, the paddy, the husked rice non-parboiled, the husked rice parboiled and the milled rice parboiled into small bowls (A.2.4), with the aid of tweezers, scalpel and paintbrush (A.2.3). Weigh the six fractions obtained to the nearest 0.01 g and record the masses as m_1 , m_2 , m_3 , m_4 , m_5 , and m_6 .

Divide the second test portion with the divider (A.2.1) in order to obtain four different aliquot parts of about 100 g each.

Weigh the first aliquot part to the nearest 0.01 g and record the mass as m_x . Spread it out and separate the heat-damaged kernels, the damaged kernels, the immature or malformed kernels, the chalky kernels, the red kernels, together with the red-streaked kernels and the waxy rice into small bowls. Weigh the six fractions obtained to the nearest 0.01 g and record the masses as m_7 , m_8 , m_9 , m_{10} , m_{11} , and m_{16} .

Weigh the second aliquot part to the nearest 0.01 g and record the mass as m_y . Separate the chips by the test sieve (A.2.2), then spread out the remainder and separate the broken kernels, classifying them into large broken kernels, medium broken kernels and small broken kernels. Put the fractions obtained into small bowls. Weigh the four fractions to the nearest 0.01 g and record the masses as m_{12} , m_{13} , m_{14} , and m_{15} .

A.4.3.6 Husked rice, parboiled (see Figure A.3)

Weigh one of the test portions (A.4.2) to the nearest 0.1 g, record the mass as m_w , and spread it on the tray (A.2.6). Separate the inorganic extraneous matter, the organic extraneous matter, the paddy, the husked rice non-parboiled, the milled rice non-parboiled and the milled rice parboiled into small bowls (A.2.4) with the aid of tweezers, scalpel and paintbrush (A.2.3). Weigh the six fractions obtained to the nearest 0.01 g and record the masses as m_1 , m_2 , m_3 , m_4 , m_5 , and m_6 .

Divide the second test portion with the divider (A.2.1) in order to obtain four different aliquot parts of about 100 g each.

Weigh the first aliquot part to the nearest 0.01 g and record the mass as m_x . Spread it out and separate the damaged kernels, the immature or malformed kernels and the red kernels into small bowls. Weigh the three fractions obtained to the nearest 0.01 g and record the masses as m_7 , m_8 , and m_9 .

Weigh the second aliquot part to the nearest 0.01 g and record the mass as m_y . Separate the chips by the test sieve (A.2.2), then spread out the remainder and separate the broken kernels, classifying them into large broken kernels, medium broken kernels and small broken kernels. Put the four fractions obtained into small bowls. Weigh the fractions to the nearest 0.01 g and record the masses as m_{10} , m_{11} , m_{12} , and m_{13} .

Proceed with the laboratory milling of the third aliquot part. Weigh the milled rice to the nearest 0.01 g and record the mass as m_z . Spread it out and separate the heat-damaged kernels, the partly gelatinized kernels and the pecks into small bowls. Weigh the three fractions obtained to the nearest 0.01 g and record the masses as m_{14} , m_{15} , and m_{16} .

Proceed with the milling of the fourth aliquot part and determine the percentage of waxy rice according to Annex B.

A.4.3.7 Milled rice, parboiled (see Figure A.4)

Weigh one of the test portions (A.4.2) so obtained to the nearest 0.1 g, record the mass as m_w , and spread it on the tray (A.2.6). Separate the inorganic extraneous matter, organic extraneous matter, the paddy, the husked rice non-parboiled, the milled rice non-parboiled and the husked rice parboiled into small bowls (A.2.4), with the aid of tweezers, scalpel and paintbrush (A.2.3). Weigh the six fractions obtained to the nearest 0.01 g and record the masses as m_1 , m_2 , m_3 , m_4 , m_5 , and m_6 .

Divide the second test portion with the divider (A.2.1) in order to obtain four different aliquot parts of about 100 g each.

Weigh the first aliquot part to the nearest 0.01 g and record the mass as m_x . Spread it out and separate the heat-damaged kernels, the damaged kernels, the immature or malformed kernels, the red kernels, together with the red streaked kernels, the partly gelatinized kernels and the pecks into small bowls. Weigh the six fractions obtained to the nearest 0.01 g and record the masses as m_7 , m_8 , m_9 , m_{10} , m_{11} , and m_{12} .

Weigh the second aliquot part to the nearest 0.01 g and record the mass as m_y . Separate the chips by the test sieve (A.2.2), then spread out the remainder and separate the broken kernels, classifying them into large broken kernels, medium broken kernels and small broken kernels. Put the fractions obtained into small bowls. Weigh the four fractions to the nearest 0.01 g and record the masses as m_{13} , m_{14} , m_{15} , and m_{16} .

Weigh the third aliquot part to the nearest 0.01 g and determine the percentage of waxy rice (3.5) according to Annex B.

A.5 Expression of results

Report the result obtained for the categories given in Table A.1 as a mass fraction, expressed as a percentage, of the product as received.

Table A.1 — Expression of results

Categories	Husked rice non-parboiled ^a	Milled rice non-parboiled ^b	Husked rice parboiled ^c	Milled rice parboiled ^d
Organic extraneous matter	$\frac{m_1 \times 100}{m_w}$	$\frac{m_1 \times 100}{m_w}$	$\frac{m_1 \times 100}{m_w}$	$\frac{m_1 \times 100}{m_w}$
Inorganic extraneous matter	$\frac{m_2 \times 100}{m_w}$	$\frac{m_2 \times 100}{m_w}$	$\frac{m_2 \times 100}{m_w}$	$\frac{m_2 \times 100}{m_w}$
Paddy	$\frac{m_3 \times 100}{m_w}$	$\frac{m_3 \times 100}{m_w}$	$\frac{m_3 \times 100}{m_w}$	$\frac{m_3 \times 100}{m_w}$
Husked rice, non-parboiled	Not applicable	$\frac{m_4 \times 100}{m_w}$	$\frac{m_4 \times 100}{m_w}$	$\frac{m_4 \times 100}{m_w}$
Milled rice, non-parboiled	$\frac{m_4 \times 100}{m_w}$	Not applicable	$\frac{m_5 \times 100}{m_w}$	$\frac{m_5 \times 100}{m_w}$
Husked rice, parboiled	$\frac{m_5 \times 100}{m_w}$	$\frac{m_5 \times 100}{m_w}$	Not applicable	$\frac{m_6 \times 100}{m_w}$
Milled rice, parboiled	$\frac{m_6 \times 100}{m_w}$	$\frac{m_6 \times 100}{m_w}$	$\frac{m_6 \times 100}{m_w}$	Not applicable
Heat-damaged kernels	$\frac{m_{14} \times 100}{m_z}$	$\frac{m_7 \times 100}{m_x}$	$\frac{m_{14} \times 100}{m_z}$	$\frac{m_7 \times 100}{m_x}$
Damaged kernels	$\frac{m_7 \times 100}{m_x}$	$\frac{m_8 \times 100}{m_x}$	$\frac{m_7 \times 100}{m_x}$	$\frac{m_8 \times 100}{m_x}$
Immature and/or malformed kernels	$\frac{m_8 \times 100}{m_x}$	$\frac{m_9 \times 100}{m_x}$	$\frac{m_8 \times 100}{m_x}$	$\frac{m_9 \times 100}{m_x}$
Chalky kernels	$\frac{m_{15} \times 100}{m_z}$	$\frac{m_{10} \times 100}{m_x}$	Not applicable	Not applicable
Partly gelatinized kernels	Not applicable	Not applicable	$\frac{m_{15} \times 100}{m_z}$	$\frac{m_{11} \times 100}{m_x}$
Pecks	Not applicable	Not applicable	$\frac{m_{16} \times 100}{m_z}$	$\frac{m_{12} \times 100}{m_x}$
Red and red-streaked kernels	$\frac{m_9 \times 100}{m_x}$	$\frac{m_{11} \times 100}{m_x}$	$\frac{m_9 \times 100}{m_x}$	$\frac{m_{10} \times 100}{m_x}$
Waxy rice	$\frac{m_{16} \times 100}{m_z}$	$\frac{m_{16} \times 100}{m_x}$	$\frac{m_{17} \times 100}{m_{17} + m_{18}}$	$\frac{m_{17} \times 100}{m_{17} + m_{18}}$
Large broken kernels	$\frac{m_{10} \times 100}{m_y}$	$\frac{m_{12} \times 100}{m_y}$	$\frac{m_{10} \times 100}{m_y}$	$\frac{m_{13} \times 100}{m_y}$
Medium broken kernels	$\frac{m_{11} \times 100}{m_y}$	$\frac{m_{13} \times 100}{m_y}$	$\frac{m_{11} \times 100}{m_y}$	$\frac{m_{14} \times 100}{m_y}$
Small broken kernels	$\frac{m_{12} \times 100}{m_y}$	$\frac{m_{14} \times 100}{m_y}$	$\frac{m_{12} \times 100}{m_y}$	$\frac{m_{15} \times 100}{m_y}$
Chips	$\frac{m_{13} \times 100}{m_y}$	$\frac{m_{15} \times 100}{m_y}$	$\frac{m_{13} \times 100}{m_y}$	$\frac{m_{16} \times 100}{m_y}$
Average length	\bar{L}	\bar{L}	\bar{L}	\bar{L}
Coefficient of variation of the length	C_v	C_v	C_v	C_v
^a For the meaning of the symbols, refer to Figure A.1. ^b For the meaning of the symbols, refer to Figure A.2. ^c For the meaning of the symbols, refer to Figure A.3. ^d For the meaning of the symbols, refer to Figure A.4.				

Report the result for each category to one decimal place by rounding it to the nearest integral multiple. If there are two successive integral multiples equally near to the given number the even integral multiple should be selected as the rounded number. Carry out the rounding always in one step [1].

Although ISO 80000-1 specifies two different rules for rounding if there are two successive integral multiples equally near to the given number, for the purposes of this International Standard the above-mentioned rule (rule A in ISO 80000-1) should be used, as in this way the rounding errors are minimized.

EXAMPLES

Given number	Rounded number
18.23	18.2
18.26	18.3
18.37	18.4
18.25	18.2
18.35	18.4
18.347	18.3
18.251	18.3

A.6 Test report

The test report shall specify:

- all information necessary for the complete identification of the sample;
- the sampling method used, if known;
- the sample mass;
- the test method used, with reference to this standard;
- the date of analysis;
- any operating details not specified in this annex, or regarded as optional, together with details of any incidents likely to have influenced the results;
- the test results obtained.

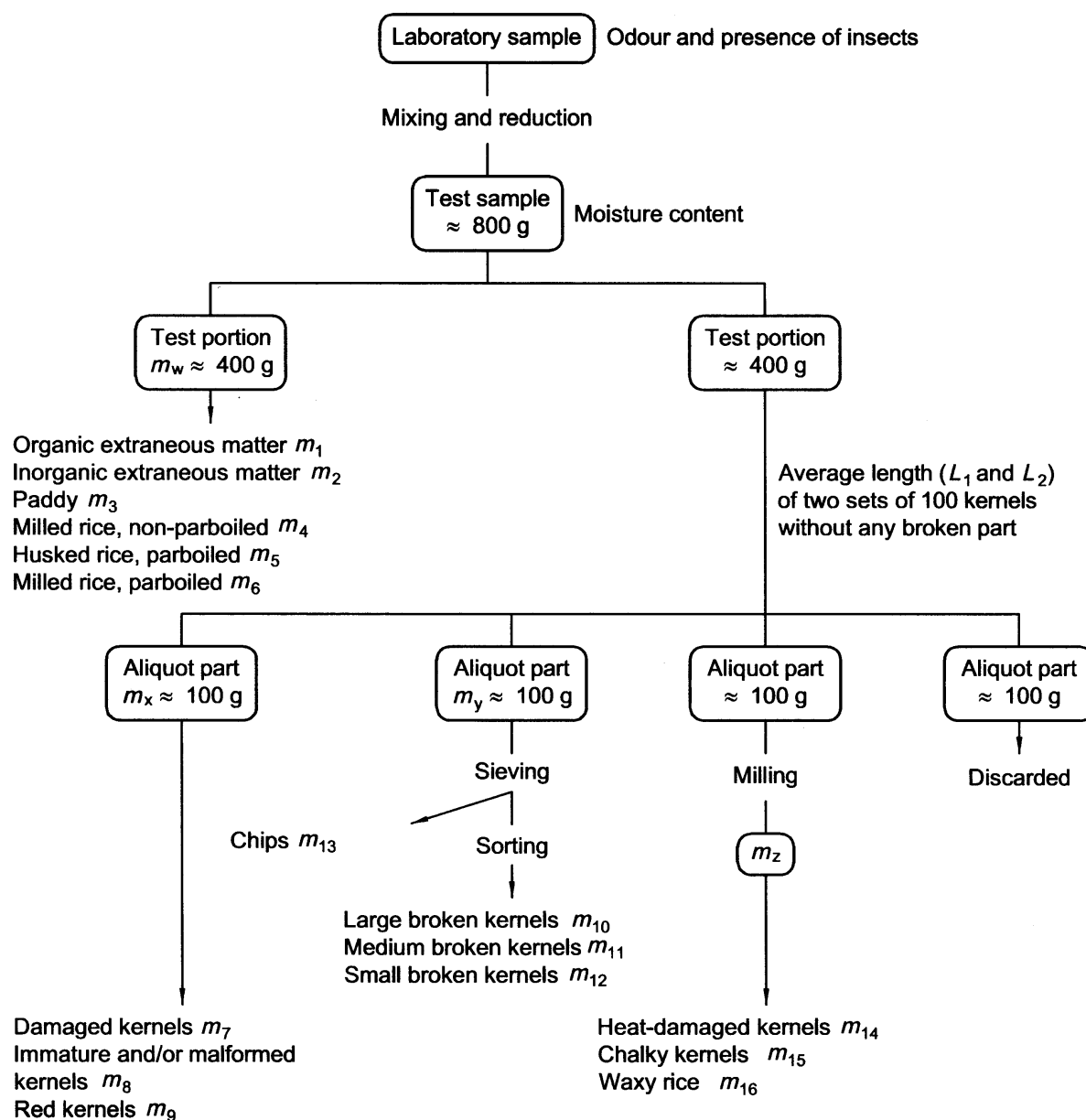


Figure A.1 — Scheme of procedure for husked rice, non-parboiled

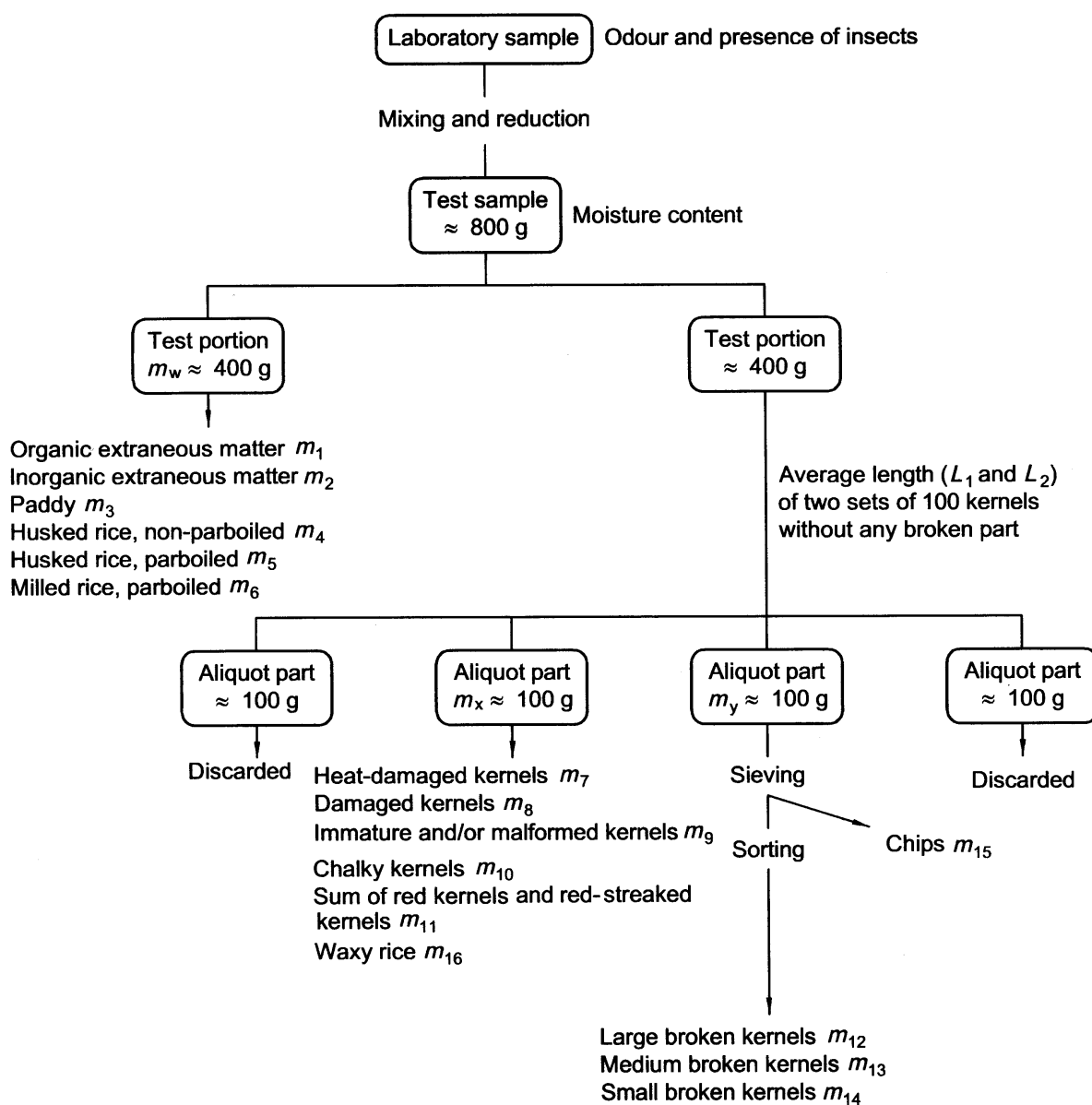


Figure A.2 — Scheme of procedure for milled rice, non-parboiled

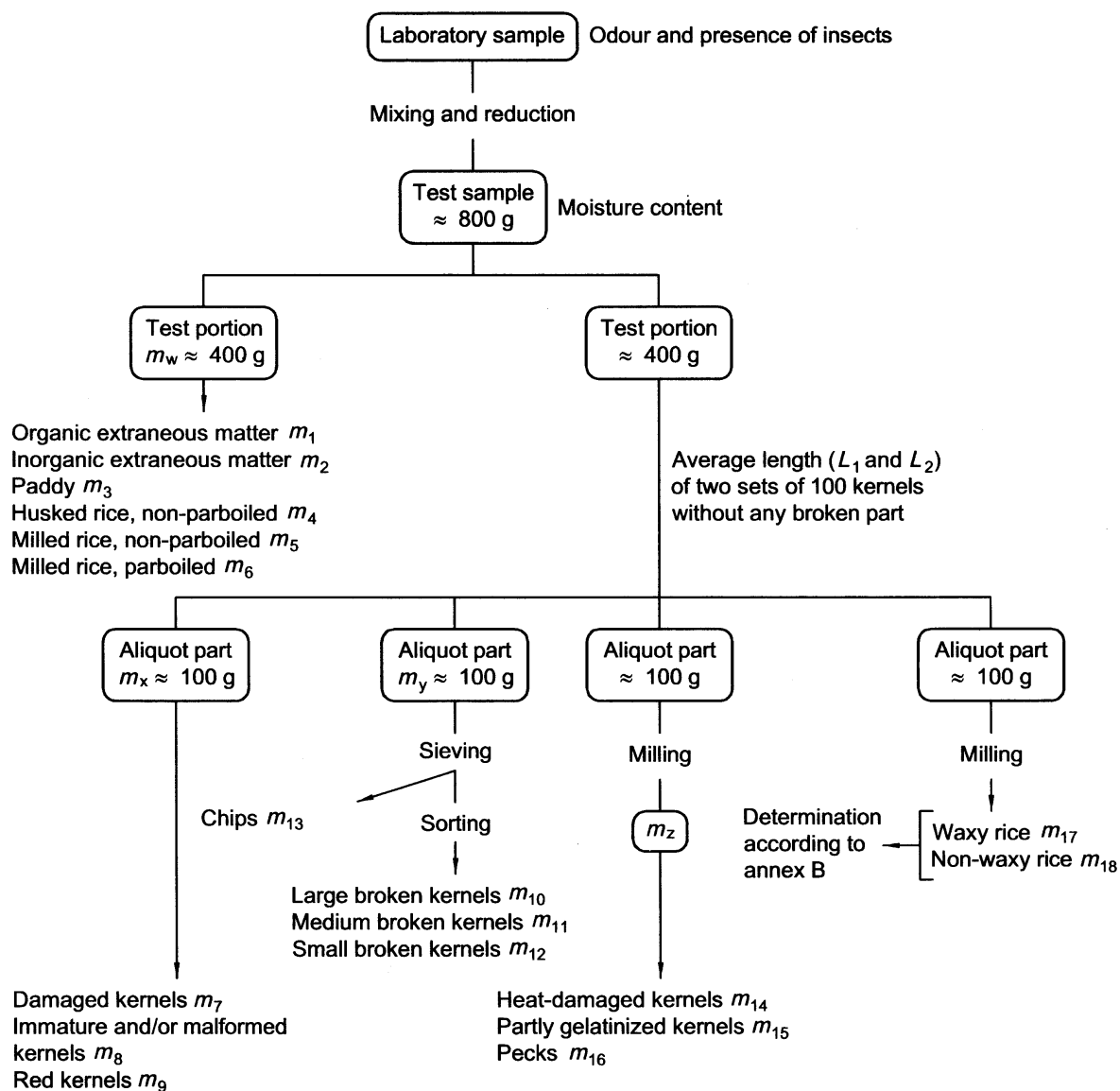


Figure A.3 — Scheme of procedure for husked rice, parboiled

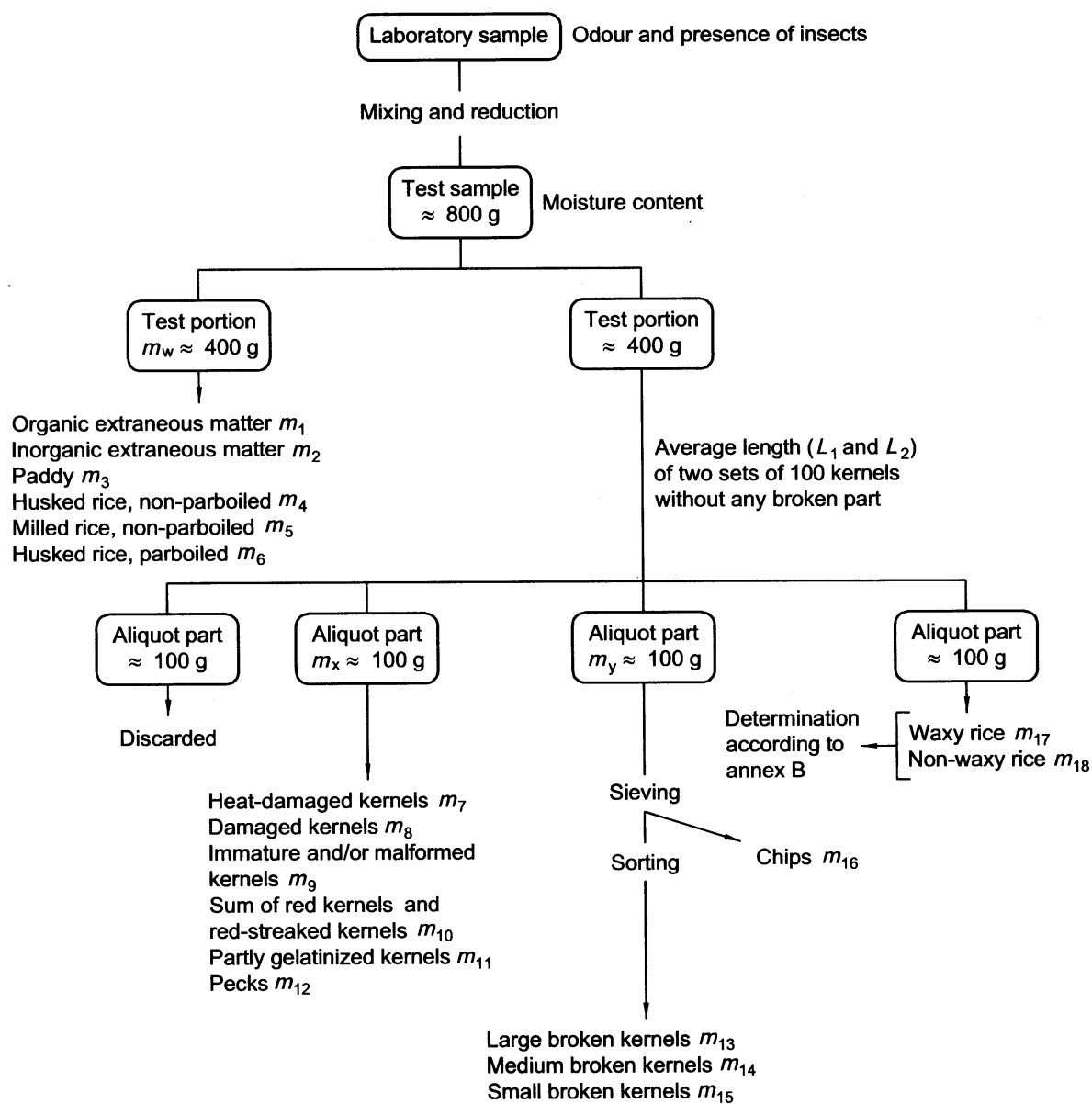


Figure A.4 — Scheme of procedure for milled rice, parboiled

Annex B
(normative)

Determination of waxy rice in parboiled rice

B.1 Principle

Waxy rice kernels have a reddish brown colour when stained in an iodine solution, while non-waxy rice kernels show a blue colour.

B.2 Reagents and materials

During the analysis, unless otherwise stated, use only reagents of recognized analytical grade and distilled or demineralized water or water of equivalent purity.

B.2.1 Iodine stock solution, containing 0.2 g iodine and 2.0 g potassium iodide in 100 ml water.

B.2.2 Iodine working solution, dilute the stock solution (B.2.1) two times (by volume) with water. Prepare daily.

B.2.3 Tissue paper.

B.3 Apparatus

B.3.1 Balance, capable of being read to the nearest 0.01 g.

B.3.2 Glass beaker, capacity 250 ml.

B.3.3 Small white-coloured bowls, or any white-coloured container.

B.3.4 Wire basket.

B.3.5 Stirrer rod.

B.3.6 Tweezers or forceps.

B.4 Sampling

Sampling is not part of the method specified in this standard. A recommended sampling method is given in ISO 24333.

It is important the laboratory receive a truly representative sample which has not been damaged or changed during transport or storage.

B.5 Determination

B.5.1 Weigh a portion of about 100 g milled rice and put it into a glass beaker (B.3.2).

B.5.2 Add approximately 80 ml of iodine working solution (B.2.2) to soak the kernels and stir until all the kernels are submerged under the solution. Let the kernels soak in the solution for 30 s.

B.5.3 Pour the rice and solution into a wire basket (B.3.4) and shake the basket slightly in order to drain out the solution. Then place the basket on a piece of tissue paper (B.2.3) to absorb the excess liquid.

B.5.4 Pour the stained kernels into a bowl (B.3.3). Separate the reddish brown kernels of waxy rice from the dark blue kernels of non-waxy rice.

B.5.5 Weigh the waxy rice portion, m_{17} , and the non-waxy rice portion, m_{18} , to the nearest 0.1 g.

B.5.6 Calculate the waxy rice content, w , expressed as a percentage mass fraction, from the equation:

$$w = \frac{m_{17}}{m_{17} + m_{18}} \times 100 \%$$

Draft African Standard for comments only — Not to be cited as African Standard

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